

ABSTRACT  
DISCRETE MULTITONE TRANSMISSION SYSTEMS

- Systems for generating a discrete multitone signal are provided in which  $N$  carriers,
- 5 corresponding to respective subchannels, are modulated in each sample period ( $T$ ) of the signal by performing an inverse discrete Fourier transform of  $N$  modulation symbols  $(X_k, \tilde{X}_k)$ , each of which symbols  $(X_k, \tilde{X}_k)$  represents a signal point in a QAM constellation for a respective subchannel, the QAM constellation comprising a basic constellation of  $M \geq 2^m$  signal points where  $m$  is the number of data bits to be communicated over the subchannel in a sample period.
- 10 For each of  $N_c \leq N$  of the subchannels, an expanded QAM constellation is defined which comprises  $pM$  signal points including said basic constellation of points, where  $p$  is an integer greater than 1. In each expanded constellation,  $p-1$  equivalent signal points are defined for each signal point of the basic constellation, where each of the  $p-1$  equivalent points is selected from redundant points in the opposite quadrant of the constellation to the corresponding point of the
- 15 basic constellation. The discrete multitone signal is generated in a sample period ( $T$ ) by selecting, for each of the  $N_c$  subchannels, the modulation symbol  $(X_k, \tilde{X}_k)$  representing either a basic constellation point or a corresponding equivalent point such that the peak value of the signal does not exceed a predetermined threshold.